MAGNETIC MEASUREMENTS ABOARD AN AUTOMATIC INTERPLANETARY STATION TOWARD VENUS

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ABSTRACT

Compared are field variations aboard an automatic interplanetary station (AIS) in the 165 to 175 thousand km range with field variations at a middle-latitude magnetic observatory. Readings of a magnetogarph and of the AIS's charged particle traps at a distance of 1900 thousand km from the Earth are compared with the variations of the field and of the intensity of cosmic rays' neutron component at the Earth's surface.

Expressed is the assumption, that the disturbance observed on the ground is not related to stream's frozen-in magnetic fields, but is the result of transformation of the stream's kinetic energy within the bounds of the magnetic field.

Author

COVER-TO-COVER TRANSLATION

Installed were in the interplanetary station (AIS) a three-component magnetometer for the measurement of the magnetic field near the planet, and a magnetic variometer to measure the field en route.

The magnetic variometer of the AIS is a two-channel instrument with independent electronic elements and pickups. The variometer's pickups were oriented in parallel so as to measure the same field component. To reduce the container's effect on instrument's readings, the pickups were fastened to a special antenna at a distance of about 2 meters from the container. The antenna was directed at an angle of 43° relative to the normal to solar batteries. The variometer's sensitivity threshold was of 2 γ. The measurement range was from 0 to 50 γ.

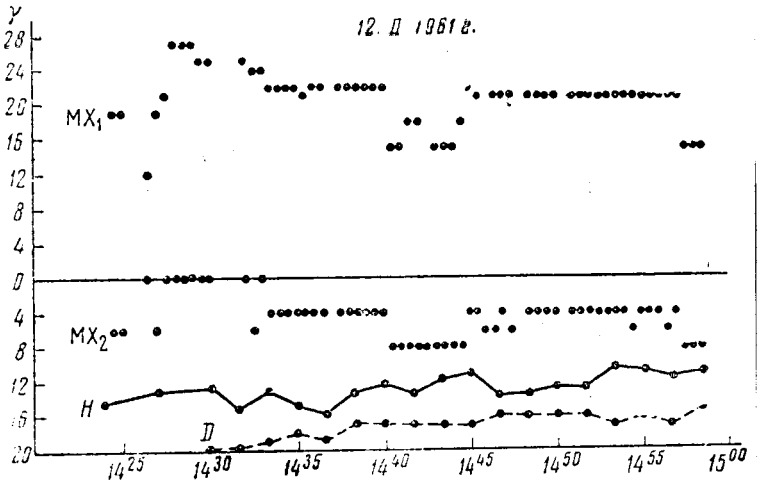
Data on sessions of February 12 and 17, 1961 were obtained through the variometer. Although this information is comratively rather small, it constitutes an unquestionable interest, for it throws light on the peculiarities of formation of a magnetic disturbance.

According to data of magnetic observatories, February 12 was magneto-quiet. Moderate magnetic disturbances took place on the 13, 16 and 17 February, the latter being most intense. Plotted are in Fig. 1 the magnetograms obtained from the AIS on 12 February while it was drifting away at distances of 165 to 175 thousand km from the Earth, thus at the magnetosphere boundary. Both variometer channels basically detect the consistent field variations within the $\pm 4\ \gamma$ limits around the average levels. Field variations have a shape of stepped variations by the strenght of the specific character of information transmission. The H and D- field component variations at the Earth's surface are shown in Fig. 1 for the same time interval (curves H and D are plotted according to data of Moscow observatory magnetograms, $\varphi = 55^{\circ}$). It may be seen that field variations at the surface of the Earth are within the same limits.

Analysis of AIS telemetric data permits to assume, that the observed field variations are not related to the interferences from aboard the AIS and reflect the real pattern of existing fluc-

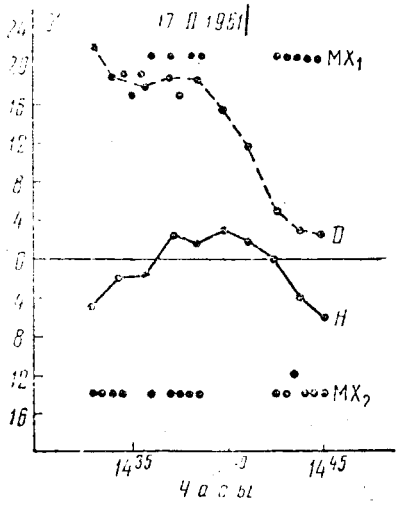
tuations of the magnetic field, in the most immediate neighborhood of the Earth, at the boundary of its magnetic field.

The following transmission of information from the AIS took place on 17 February 1961 at a distance of 1,900,000 km from the Earth



Hours

Fig. 1



Hours

Fig. 2

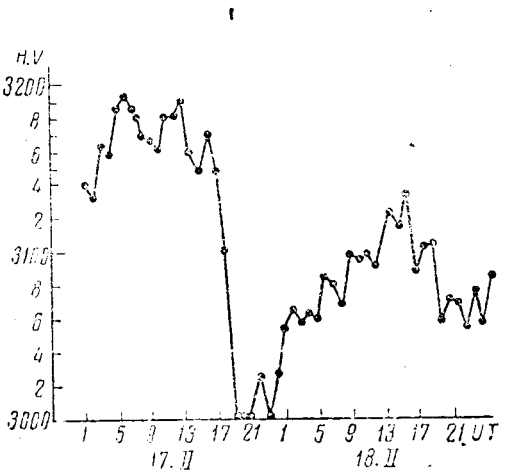


Fig. 3

The readouts by the AIS's variometers and field variations on the ground at the same time (Moscow time) are plotted in Fig. 2.

The IAS's variometers show almost invariable readouts for the total performance, whose duration was near 22 minutes. As to ground variometers, they detected notable variations during the time of the link with the AIS, and the hours immediately closest. According to the data of the middle-latitude station, they reach 20 to 25 γ.

No similitude in the curves of field variations in the AIS and on the ground could normally be anticipated, but in the given case, as may be seen from Fig. 2, the absence of synchronism in the magnetic activity according to ground and rocket-born measurements during the performance and the immediately-closest moments has been detected within the 50 — 70 minute range.

Let us note a case which is essential during the discussion of the results of magnetic measurements from the AIS : The AIS-installed charge particle traps, having measured the low-energy corpuscular radiation, have detected during the 17 February performance certain changes by comparison with the 12 February that may only be explained in the assumption that on 17 February the AIS was located within the limits of a corpuscular stream (see K. I. Gringauz., "Izvestiya" of 22 February 1962). The readings of that instrument during the whole performance of 17 Feb. just as those of magnetic variometers remained unchanged.

The comparison of indications of the levels of variometer channels' readouts for February 12 and 17 leads to a representation of the magnitude of the magnetic field which could have been carried along by the corpuscular stream revealed by the AIS's particle traps.

As may be seen from Fig. 1 and 2, the readout level of one of the variometers (MX_1) did not practically vary on the 17th by comparison with the 12th February. That of the other variometer (MX_2) varied by 9γ. This points to variometers' zero drift during 5 days of absence of information from the AIS. It is thus not known

which one of the two variometers detected the instability of the zero value, one may only estimate that the component of the stream's field along the axis of the pickups was $\leq 9\gamma$. It is most likely that this component did not exceed 2γ.

The representation about the magnetic field of a corpuscular stream in the closest vicinity of the Earth during the same time interval may be obtained from the character of cosmic ray variation at the Earth's surface. Data on variations of the neutron component of cosmic rays for 17 February 1961, as observed at the Yungfrau- station, are plotted in Fig. 3 (the curve 3 being plotted according to data sent by Prof. N. S. Hautermans to the Center of IGY =B2 data preservation).

As may be seen from the comparison of figures 2 and 3, the Forbush effect on the ground during the magnetic disturbance of 17 February 1961 commenced 6 hours after the observation from the AIS, and reached the maximum 9 hours after the commencement.

Hence it follows, that at the moment of observation in the AIS the field of the stream was not only small in its vicinity, but also near the Earth, and that the cause of spontaneous geomagnetic disturbances on Earth on 17 Feb, during the period of AIS performance, was not in the frozen-in magnetic fields of the stream, but apparently in the direct interaction of the corpuscular stream with the magnetic field of the Earth.

From the comparison of terrestrial experimental data and of those of the AIS, one may conclude that apparently a correlation was lacking in the given experiment (contrary to the experiment of Pioneer V) between the disturbance of the magnetic field at the Earth and in the interplanetary space.

We consider it our duty to express our thanks to Yu. D. Kalinin and E. P. Mustel' for the discussion of materials, and also to Yu. V. Afanas'yeva, O. A. Logachev for their participation in the processing and in the tuning of the instrumentation.

*** END ***

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NO REFERENCES

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